

3.7 HAZARDOUS MATERIALS, SITE CONTAMINATION AND POLLUTION PREVENTION

This section describes hazardous materials and site contamination at Ames Research Center. It is divided into three subsections. The first deals with the types and quantities of hazardous material and wastes found at Ames Research Center, and the safety and environmental procedures in place for handling them. The second describes the Regional Plume, a plume of contaminated groundwater that underlies approximately 130 hectares (320 acres) of Ames Research Center. The third describes sites contaminated by the Navy's pre-1994 use of Moffett Field, and NASA's use of the Ames Campus, as well as their remediation status.

A. *Hazardous Materials and Wastes*

Because Ames Research Center is home to a large number of research and development projects, many different hazardous substances are used there. At any given time, there may be more than 5,000 hazardous substances in the laboratories, shops, and other facilities within the Ames Campus area, producing a comparable number of types of hazardous waste. The quantities from laboratories are often small: ounces or grams of particular substances; quantities from shops and other operations may be greater than 55 gallons.¹

A number of protocols are in place throughout Ames Research Center to control the hazards associated with hazardous substances and to minimize the risks of exposure or spills:

- The **Ames Environmental Procedures and Guidelines** ensure that the Center meets all federal, State, and local hazardous materials and hazardous waste regulations.
- The **Hazardous Waste Minimization Plan** prescribes actions that will reduce Ames Research Center's hazardous waste output.
- The **Spill Prevention Control and Countermeasures Plan** identifies response procedures for spills of contaminants, and includes assignment of

¹ *Draft Environmental Resources Document for the National Aeronautics and Space Administration Ames Research Center*, 2000.

containment and clean-up responsibilities among the departments at NASA, as well as site-specific contingency plans.

- The **Hazard Communication Plan** identifies sources of information on hazardous materials.²
- The **Radiation Safety Committee** supervises and monitors all activities at Ames Research Center that might involve radiation hazards.³
- The **Hazardous Substance Reporting Protocols** set procedures for reporting hazardous substances to outside regulatory agencies, which is done by the NASA Ames Environmental Services Office. Other personnel report hazardous substance inventory to the NASA Ames Environmental Services Office, and report hazardous substance spills to the NASA Ames Duty Office, which activates the spill response system.⁴
- The **Hazardous Waste Disposal Procedures** at Ames Research Center require that all hazardous wastes be transported to secure, ventilated packaging areas, from which they are packaged and transported to State- and federally-authorized treatment or disposal sites.⁵
- The **Radioactive Waste Disposal Procedures** require that all radioactive wastes be stored in a bunker near Building N-218. Approximately every three months, a licensed contractor removes the waste from the bunker and takes it to authorized disposal sites within the United States.⁶ NASA

² Ames Health and Safety Manual, APG 1700.1

³ *Draft Environmental Resources Document for the National Aeronautics and Space Administration Ames Research Center.* 2000.

⁴ As required by Santa Clara County.

⁵ *Draft Environmental Resources Document for the National Aeronautics and Space Administration Ames Research Center.* 2000.

⁶ *Draft Environmental Resources Document for the National Aeronautics and Space Administration Ames Research Center.* 2000.

is also authorized to hold radioactive material with a physical half-life of less than 120 days for decay-in-storage before disposal.

B. Pollution Prevention

Ames Research Center is in the process of implementing NASA's Environmental Excellence for the 21st-Century strategy, which includes a pollution prevention plan consistent with the requirements of relevant Federal and State regulations and laws.⁷ ARC has reduced solid and hazardous waste production, minimized impacts to the environment, and controlled air emissions through a variety of methods and technologies. In addition, ARC has routinely implemented recycling and educational programs to reach the ARC community and bring environmental issues to the forefront. In accordance with Executive Orders 13101, 13148, 13149 and 13150, ARC's goal is to increase waste prevention, recycling, and the purchase and use of recycled content and environmentally preferable products and services.

The following are some of the pollution prevention programs and activities that are currently being implemented at ARC:

- **Composting and Soil Bioremediation.** All landscaping green waste is composted or made into mulch at Building N-267 for future landscaping use.
- **Recycling.** Some of the items ARC is currently recycling include white paper, mixed paper, cardboard, toner cartridges, various types of batteries, fluorescent lamps, certain solvents, waste oil, oil filters, scrap metal, tires, computers, construction and demolition waste, and empty drums. A

⁷ NASA Procedures and Guidelines- 8820.3

benchmarking project recycling plastics, glass and aluminum cans is scheduled to begin in fall 2002, followed by full implementation in 2003.⁸

- **Chemicals and ODS.** Unused chemicals that are in good and stable condition are reused onsite through the *Ames Chemical Exchange* (ACE) program. All chemicals onsite are tracked through a *Hazardous Materials Inventory Control System* (HMICS) to ensure safety and possible source reduction. Ozone Depleting Substances (ODS) continue to be reduced and eliminated whenever possible through process modifications and chemical substitutions.
- **Motor Pool.** The motor pool currently recycles coolant, oil filters and oils and uses recycled oil. In addition, retread tires are utilized when possible.
- **Affirmative Procurement.** ARC continues to promote affirmative procurement and uses recycled products whenever possible as the default items procured through Stores Stock, in accordance with Comprehensive Procurement Guidelines (CPG) and EO 13101.
- **Energy.** ARC reduces energy use whenever possible through a combination alternative source of energy projects, relamping initiatives, centerwide e-mails, and use of the *Energy Saving Program Contract* (ESPC).
- **Integrated Pest Management (IPM) and Integrated Vegetative Management (IVM).** In 1997, ARC implemented an IVM program. This program mandates the use of less toxic herbicides, a reduction in the use of herbicides, and the use of endemic, drought-tolerant flora. One innovative method that supports the IVM program is the use of goats. In 1995, ARC implemented an IPM program. ARC was awarded the *Pest Management Alternatives Pioneer Award* in 1998 by *Californians for Pesticide Reform*. Since 1997, pesticide use has been reduced by 97 percent. In 2002, ARC received an award from the EPA for this program.

⁸ Diane Shelander, Ames Research Center, March 6, 2002.

- **Training and Awareness.** Training and outreach programs run throughout the year. Some of these activities include seminars, centerwide e-mails, America Recycles Day, Earth Day, Pollution Prevention Week, organization-specific training, and a general *Hazardous Materials and Environmental Essentials* course.
- **ARC Pollution Prevention Award.** The Pollution Prevention (P2) award was created in 1994 to laud employees for pollution prevention activities.
- **Industrial Waste Water Treatment Facility.** ARC operates a facility that treats industrial wastewater through micro-filtration and reverse osmosis in order to recycle water for use in selected research operations.

C. *The Regional Plume*

A plume of contaminated ground water flows northwards beneath Ames Research Center towards the San Francisco Bay. At present, the plume underlies a total of 130 hectares (320 acres) of Ames Research Center, most of which is within the NRP area. The main contaminants in the plume are volatile organic compounds, among them trichloroethene, 1,1,1 trichloroethane, cis- and trans- 1,2 dichloroethene, 1,1 dichloroethane, 1,1 dichloroethene, dichlorobenzene, chloroform, freon 113, phenol, and vinyl chloride. The first two are the most commonly found.⁹

The Regional Plume stems from two main sources: an EPA-designated Super Fund site outside of Ames Research Center at the Middlefield-Ellis-Whisman (MEW) site across Highway 101, and contamination from the operation of a dry cleaning facility, a former aircraft wash rack and sump, a fueling station, and numerous underground storage tanks at Moffett Field during the Navy's

⁹ *Environmental Baseline Survey*, Harding Lawson Associates. October 18, 2000. p.14.

administration of the base.¹⁰ EPA and the companies responsible for the MEW contamination signed a record of decision in 1989 that included an agreement on how and to what level the MEW Superfund site would be remediated. EPA later determined that the cleanup of groundwater and soils at Moffett Field contaminated by the MEW plume was subject to the MEW record of decision. The Navy and the MEW companies are thus jointly conducting remediation under EPA supervision, with periodic monitoring to evaluate the progress of remediation efforts. As of 1997, both the Navy and the MEW companies had designed and installed coordinated permanent remediation systems. NASA has also contributed contamination in the northern portion of the plume. In response, NASA has installed a remediation system which started operation in September 2001. EPA and the California Regional Water Quality Control Board are the oversight agencies for clean-up of the Regional Plume. Sampling has been conducted to determine whether volatilization of contaminants in the plume are contaminating soils or indoor air quality. The results of this sampling is discussed in Section 3.4: Air Quality.

D. Site Contamination

This section describes the 26 Navy contamination sites and two treatment systems, the 13 NASA contamination sites and one treatment system within the Ames Campus, and a number of other potential sources of contamination.

1. Navy Sites

Although control of Moffett Field was transferred from the US Navy to NASA in 1994, the Navy is responsible for cleaning up any contamination from its earlier use of the base. To date, 26 potentially-contaminated sites have been identified at Ames Research Center, predominantly along the western edge of the airfield and near Hangar Three, all of which pre-date NASA's administration of the property. Figure 3.7-1 identifies the potentially-

¹⁰Op. Cit.

contaminated sites at Ames Research Center. These sites were contaminated by wastes from 60 years of military operations. Contaminants include waste oils and fuel products, solvents and cleaning products, pesticides, paint, battery acids, and polychlorinated biphenyls (PCBs). Both the EPA and RWQCB are oversight agencies for all Navy sites.

The following list describes each of the 28 identified Navy sites and describes their current remediation status:¹¹

- Site 1: a former landfill, approximately 6 hectares (14 acres) in size, that was used between 1963 and 1975. The landfill received not only domestic garbage, but also waste from maintenance and military operations, including solvents, oil, paint, paint thinners, scrap metal, and sawdust contaminated with PCBs. Testing has determined that while there is no groundwater contaminant migration from this landfill, there are gas emissions, primarily methane, from decomposing garbage. This landfill has been capped with a multilayer cover as described in the Navy's Record of Decision in accordance with their Federal Facilities Agreement and CERCLA requirements. Gas and groundwater collection trenches were dug. The groundwater and gas trenches are sampled periodically. If leachate or gas were detected, additional remediation action would be taken.
- Site 2: a former landfill approximately two hectares (five acres) in size which was operated from the 1940's through approximately 1963. This landfill is located approximately 500 meters (1,600 feet) south of Site 1, just west of the golf course. It received the same types of wastes as Site 1. The Navy, in cooperation with regulatory agencies, consolidated Sites 1 & 2 in 1997.
- Site 3: a ditch along the eastern side of Marriage Road that is located approximately 2 meters (five to six feet) below grade. Storm drains located in and near Hangars 2 and 3 discharged detergents, hydraulic fluids, oils,

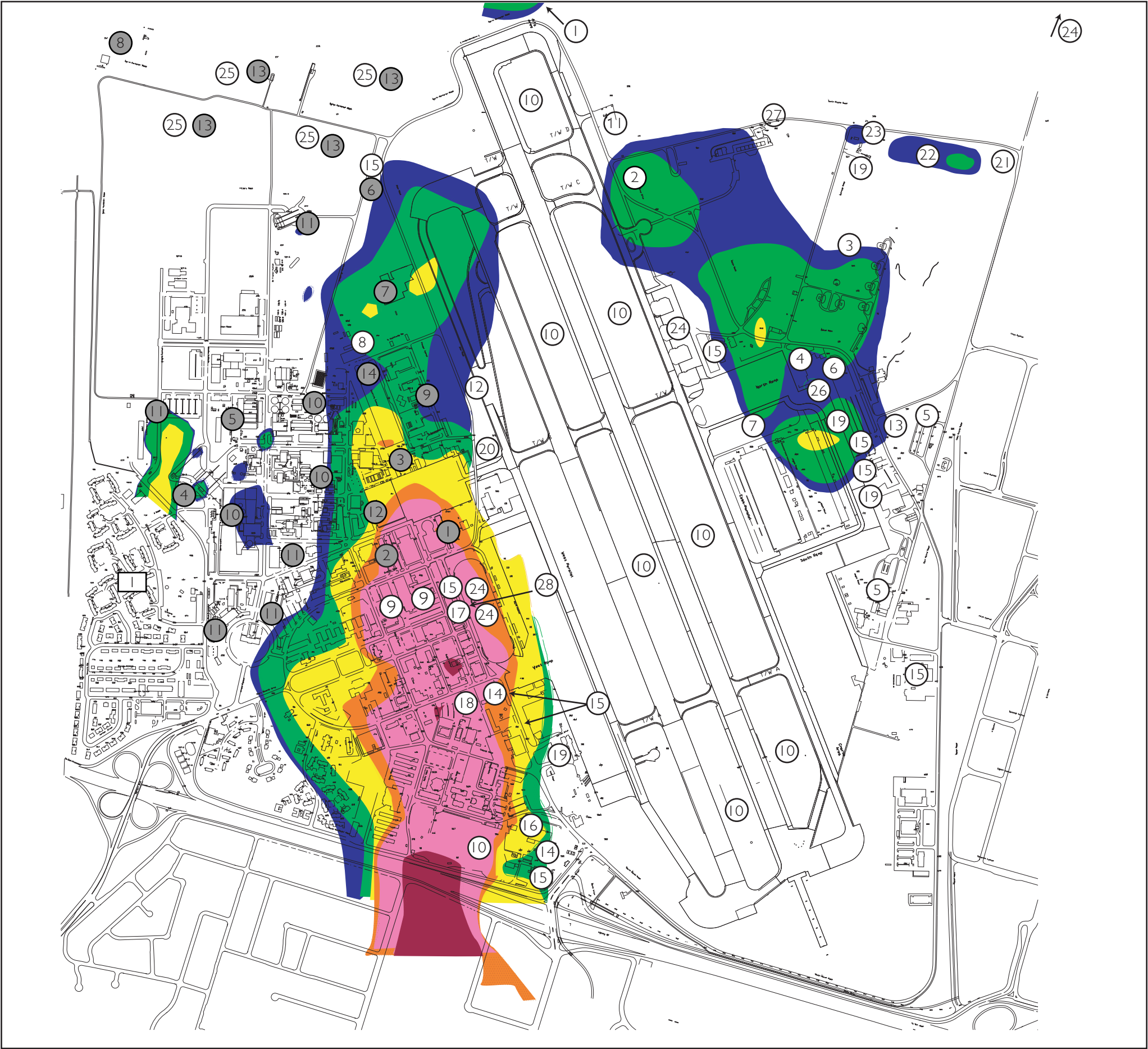
¹¹ Personal communication with Don Chuck. 2001.

fuels, solvents, detergents, paint, and paint stripper into this ditch, parts of which are lined with concrete. Investigation in 1993 found no evidence of risks to human health or water quality, and a No Action Record of Decision was signed by the Navy, US EPA, the State of California Department of Toxic Substances Control, and the San Francisco Bay Regional Water Quality Control Board. A relatively low level of solvent contamination was found in the aquifer below the site. The slightly contaminated groundwater is being treated aboveground using air stripping.

- Site 4: this former industrial wastewater holding pond was unlined and received approximately 57 million liters (15 million gallons) of wastewater from airfield operations including aircraft washing and equipment maintenance. It was removed, closed, and replaced by new ponds in the late 1970s. During the remedial investigation, no unacceptable risks to human health were identified and a no-action record of decision (ROD) was signed in October 1994. Risk due to exposure to beryllium in soil was identified, but beryllium concentrations were found to be naturally occurring and no remedial action was appropriate. The site is completely paved, so there are no ecological risks. No further action is planned for the site. Groundwater contamination that may have occurred due to the ponds is now being treated by the East Side Aquifer Treatment System.
- Site 5: the main fuel facility for Moffett Field. The fuel farm site is divided into two parts: Site 5 north and south. Originally, the fuel farm consisted of 10 underground bulk storage tanks and four aboveground storage tanks. Six of the underground tanks were removed in 1995 from Site 5 south. The remaining eight tanks, four underground and four aboveground, are located in Site 5 north and are still in use. There is soil and groundwater contamination at both locations, with the heaviest contamination in Site 5 north. The Navy is currently studying the site as part of its petroleum

FIGURE 3.7-1

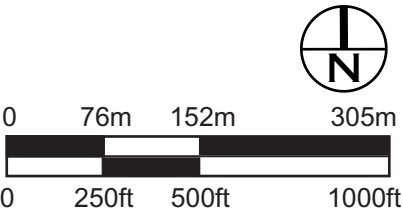
HAZARDOUS MATERIALS
SITES AND PLUMES



- Navy Cleanup Sites**
 - 1. Runway Landfill
 - 2. Golf Course Landfill
 - 3. Marriage Road Ditch
 - 4. Former Industrial Wastewater Surface Impoundments
 - 5. Fuel Farm French Drains
 - 6. Unpaved Areas Surrounding Runway Apron
 - 7. Hangars 2 and 3
 - 8. Waste Oil Transfer Area
 - 9. Old Fuel Farm
 - 10. Runway Chase Park Area
 - 11. Engine Test Stand Area
 - 12. Firefighting Training Area
 - 13. Equipment Parking Area
 - 14. Abandoned Tanks (all Removed)
 - 15. Nine Sumps Oil/Water Separators
 - 16. PW Steam Rack Sump (Removed)
 - 17. Paint Shop Sump
 - 18. Dry Cleaners Sump
 - 19. Leaking Tanks
 - 20. Zook Road Fuel Spill
 - 21. Patrol Ditch Road
 - 22. Golf Course Landfill #2
 - 23. Golf Course Landfill #3
 - 24. Active Petroleum Sites
 - 25. Eastern-Diked Marsh and Storm Retention Ponds
 - 26. East-Side Aquifer Treatment System
 - 27. Northern Channel
 - 28. Westside Aquifer Treatment System
- NASA Areas of Investigation**
 - 1. Former Jet Fuel Depot Area
 - 2. Detection of TCE
 - 3. Leaking Tanks (all Removed)
 - 4. Leaking UST's (Some Removed)
 - 5. Electrical Substations
 - 6. Storm Drain Channel
 - 7. Detection of VOC's
 - 8. Detection of Petroleum Hydrocarbons
 - 9. Detection of Petroleum Hydrocarbons and Solvents
 - 10. Detection of PCB's and TEPH
 - 11. UST's
 - 12. Former Underground Storage Tanks and Detection of PCB's
 - 13. Detection of PCB's, DDT, Lead and Zinc
 - 14. NASA's Regional Groundwater Treatment System
- Other**
 - 1. Orion Park Military Housing Area

Total Toxic Organics
Regional Groundwater Plume

- 1-10 ug/l
- 11-100 ug/l
- 101-500 ug/l
- 501-11,000 ug/l
- 1,001-5,000 ug/l
- >5,000 ug/l



sites evaluation and closure program to determine what remediation will be needed. There is no remediation effort currently underway at Site 5.

- Site 6: an area just north of Hangars Two and Three where it is believed that liquid wastes from aircraft maintenance, including paint, paint stripper, oil, fuel, and solvents may have been dumped before it was paved in 1979. See the description of Site 3, above, for information on current status and treatment.
- Site 7: an area including both Hangars Two and Three and the unpaved and paved areas around them. Unpaved areas in the corners of each of the Hangars were used to dispose of liquid wastes from aircraft maintenance, including solvents, fuel, paint, paint stripper, and hydraulic fluid. In addition, a power plant in the northeastern corner of Hangar Three may have dumped solvents on unpaved areas around that Hangar. See the description of Site 3, above, for information on current status and treatment.¹²
- Site 8: this former oil transfer area is located in the northeastern portion of the Ames Campus area. From the 1940's through 1981, this area had a 19,000 liters (5,000 gallon) waste oil tank and sump, which reportedly also received transformer oils (possibly containing PCBs) and solvents. Oil spilled during transfer contaminated some soils on the site. The tank and sump were removed in 1981, and NASA remediated contaminated soils in the northern portion of Site 8 adjacent to NASA's AOI 7 through excavation and off-site disposal in 1994.¹³
- Site 9: two former groups of underground fuel tanks and their associated piping. Fuel leakage from the tanks and pipes contaminated both subsurface soils and groundwater. Groundwater contamination from Site 9 mixed with the solvents in the Regional Plume, and is being remediated

¹² Ibid, pages 6 and 7.

¹³ Ibid, page 7.

by the Westside Aquifer Treatment System. The Navy determined that the soil contamination met the Regional Water Quality Control Board's requirements for low-risk closure, so no further work on the soil is planned.

- Site 10: no contaminant sources have been identified at Chase Park, but the groundwater is contaminated with volatile organic compounds from the MEW site. This site is being remediated by the pump and treat system installed to clean up the MEW groundwater contamination plume.
- Site 11: an area near the northeastern end of the runway that was used to test aircraft engines. The site is covered with a concrete and asphalt pad, but a small drainage depression likely carried spilled hydraulic fluid, waste oil, and fuel to the southern edge of the pad. See the description of Site 3, above, for information on current status and treatment.
- Site 12: the former fire-fighting training area north of Hangar 1 on the westside of the runway. Jet fuels spilled during training have contaminated subsurface soils. Most of the contaminated soils, approximately 4,200 cubic meters (5,500 cubic yards), were removed and treated in 1993. Because the site is bordered by Zook Road and the west parallel taxiway, it was not possible to remove all of the contaminated soil. The Navy evaluated the remaining contamination at Site 12, and found that it was not a threat to human or ecological receptors. No further work on the site is planned.
- Site 13: a paved area east of Hangars Two and Three that is used as parking lot. A surface drainage ditch received industrial wastewater from equipment washing, leaks, and spills. The drainage ditch flows to the main storm sewer. See the description of Site 3, above, for information on current status and treatment.
- Site 14-North: two former underground tanks located near the former dry-cleaning building, which were removed and sampled. No contamination was identified at either site.

- Site 14-South: the California Air National Guard (CANG) motor pool, which is in active use. There is both soil and groundwater contamination here from two underground tanks and their piping, which have been removed. Originally, a pump and treat system was used to remediate the site. Low permeability soils limited flow rates, however, so this approach was abandoned. Then a remediation system involving recirculating and treating the groundwater in place was operated. Currently, the Navy is allowing the site to naturally attenuate, although benzene levels in the ground water still exceed the cleanup level.
- Site 15: eight sumps, one oil/water separator, and an underground storage tank. Most have been removed, and the sites are currently being evaluated by the Navy.
- Site 16: two catch basins that drained a concrete wash pad to an underground oil/water separator. They were removed, and no contamination was found.
- Site 17: the sump for the paint shop, which received wastes including oil- and latex-based paints, thinners, toluene, and turpentine. The sump and surrounding contaminated soils were removed in 1991. No contamination remains at the site.
- Site 18: the sump on the northern (down gradient) side of the former dry-cleaning building. The sump was removed, and no contamination from it was found. However, the dry cleaning building, foundation, and underground piping were demolished and removed along with approximately 300 cubic meters (400 cubic yards) of soils contaminated with cleaning solvents. No further soil contamination exists, but groundwater contamination from the dry cleaning operation is being remediated as part of the Navy clean-up effort.
- Site 19: four underground storage tanks that have been removed. One of the tanks is believed to be a source of the solvent contamination in the groundwater in the Eastside/Airfield area. This contamination is being addressed by the Eastern Aquifer Treatment System.

- Site 20: an area north of Hangar One adjacent to the Airfield where off-specification fuels were stored in above ground tanks, which were removed in 1982. Fuels spilled from these tanks and accumulated in low areas near the taxiways, runways, and Zook Road. As a result, the soil and groundwater are contaminated with low levels of petroleum products. The Navy has determined that Site 20 meets the criteria for low-risk closure, and no further work is recommended for this site.
- Site 21: a surface drainage ditch on the northern edge of the Eastside/Airfield area that carries some of the stormwater flow from the eastern side of Ames Research Center. Reportedly, waste fluids including transmission fluid, hydraulic fluid, and motor oil were dumped here. This site is to be further evaluated for ecological risks, along with the Marriage Road Ditch and Site 27, described below.
- Site 22: a 120-meter (400-foot) wide strip of landfill in the northeastern corner of the golf course lying between East Patrol and Marriage Roads. The landfill was in active use from the late 1940s until the 1960s. There are no records of what was dumped at the site, but it is thought to be primarily household waste. The Navy has issued a proposed plan to install a biotic barrier along the sides of the landfill to prevent burrowing animals from bringing up garbage from the landfill. The Navy will also be monitoring the groundwater at the site.
- Site 23: a former landfill approximately 1 hectare (two acres) in size located immediately south of the northern weapons bunker area. There is no record of the source of the material dump, but a site walkover identified construction and landscaping materials such as concrete, asphalt, grass clippings and mulch. Aluminum airplane parts and electronic equipment were also found. There is no evidence of any hazardous materials, so no further work is planned for the site.
- Site 24: the fuel pits in Hangar One, the high-speed fuel facility on the east side of the base, and the fuel wharf. No petroleum contamination was found at the Hangar One fuel pits, though there are solvents in the

underlying groundwater. Minor amounts of contamination were found at the fuel wharf and the high speed fuel facility. The sites are being evaluated by the Navy.

- Site 25: the Eastern-diked marsh and the storm water retention pond. PCB's pesticides, and some metals require remediation in the sediments. The Navy is proposing to excavate the contaminated portions of the site and replace them with clean material.
- Site 26: the Eastside Aquifer Treatment System for addressing the solvent plume from Hangar 3. This is not itself a contaminated site.
- Site 27: the Northern Channel. The principal contaminant is PCBs. The Navy is currently studying the site in order to develop a plan to remediate it.
- Site 28: the Westside Aquifer Treatment System for remediating the Navy's portion of the Regional Plume. This is not itself a contaminated site.

2. NASA Areas of Investigation within the Ames Campus

NASA and its predecessor, NACA, have conducted research at the Ames Campus since 1940. NASA has discovered 13 contaminated areas, which it refers to as Areas of Investigation (AOI), within the Ames Campus. This section describes each of the AOIs and their current remediation status.

- AOI 1: the former jet fuel depot located in the southeast corner of the Ames Campus. Four 75,000 liter (20,000 gallon) underground storage tanks were removed from the area, and NASA excavated most of the fuel-contaminated soil in April, 1996. The extent of the remaining fuel-contaminated soil was roughly delineated in December 1996. In April 1999, a soil and groundwater study was conducted approximately 80 to 140 meters (250 to 450 feet) down-gradient of the former fuel farm. No soil contamination was found. A grab groundwater sample from one location contained TPHD at a concentration of 890 Fg/l. The oversight agencies for AOI 1 are EPA and the RWQCB.

- AOI 2: the area around Buildings N-239, N-239a, N-210, N-243, and N-243A. Well sampling results confirm that although there is an elevated level of TCE between Buildings N-210 and N-239A, shallow soil samples taken in June 1996 in the area around the well show no solvent concentrations above the clean up levels. The MEW companies are pumping and treating groundwater in this area for chlorinated solvents, but NASA currently has no further work planned in the area. The oversight agencies for AOI 2 are EPA and the RWQCB.
- AOI 3: two groups of underground storage tanks in the area between and around Buildings N-248A, N-248B and N-259 on the north side of the aircraft ramp. The tanks were known to have leaked and were removed. NASA excavated the contaminated soil in 1994 and 1995. Subsequent analyses of soil and groundwater sampled from within the eastern portion of AOI 3 have detected petroleum hydrocarbons and VOC's above clean up levels. The oversight agencies for AOI 3 are EPA and the RWQCB.
- AOI 4: twelve underground storage tanks in an area on the west side of the Ames Campus that includes the National Full-Scale Aerodynamics Complex (the 40' x 80' and 80' x 120' wind tunnels), and the surrounding area. Several of the twelve underground storage tanks have leaked and all have been removed. Two were replaced with double-wall tanks. Analyses of soil and groundwater samples from within AOI 4 have detected petroleum hydrocarbons and VOC's. NASA prepared a Removal Action Work Plan for the site that has been finalized under California Department of Toxic Substances (DTSC) oversight. In addition to the petroleum hydrocarbons, investigation along the southwest side of AOI 4 and in the Orion Park Military Housing area adjacent to it have shown TCE concentrations above clean-up levels, which appear to be flowing onto NASA property from the upgradient housing area. TCE will be studied and if necessary remediated separately. The oversight agency for AOI 4 is DTSC.

- AOI 5: two electrical substations (Buildings N-225 and N-225A), a drum storage area, and one underground storage tank located in the western portion of the Ames Campus. The drum storage area was closed in the mid-1980s, and the tank was removed in 1990. The electrical substations remain. Analyses of soil and groundwater samples from within AOI 5 have detected petroleum hydrocarbons, PCBs, and VOCs. The oversight agency for AOI 5 is DTSC.
- AOI 6: the storm drain channel and adjacent soil parallel to Lindbergh Avenue, bordered on the east by AOI 7 and by Navy Site 8. Metals, oil and grease, and PCBs were detected at this site around the channel and in the sediment in the channel. A removal action in 1994 removed most of the contaminants and Navy Site 15, Sump 64. Results from additional surface soil sampling indicate that there are low levels of contamination laterally adjacent to the former storm channel. Soil sampling has found PCB and lead levels above ecological and residential clean-up levels. NASA completed additional remediation in October 2001. The oversight agencies for AOI 6 are EPA and the RWQCB.
- AOI 7: a vertical takeoff and landing area located in the Bay View area. It is bordered to the south by a storage yard that is included in Navy Site 8. Soil and groundwater sampling have detected VOCs. Two of NASA's Regional Groundwater Remediation Plan (RGRP) wells were placed in AOI 7 in 1999. The remediation system began operations in September 2001. The oversight agencies for AOI 7 are EPA and the RWQCB.
- AOI 8: the Navarro farms area includes Building N-267 and a bioremediation pad located at the northwest corner of Ames Research Center adjacent to the North of Bay View area. Analyses of soil and groundwater have detected petroleum hydrocarbons above clean-up levels. Four monitoring wells track the quality of the groundwater. Source removal is planned, as well as an upgrade to the remediation facilities. The oversight agency for AOI 8 is DTSC.

- AOI 9: an area on the east side of the Ames Campus including Buildings N-244 and N-245, the soccer field, and a child care center. No underground storage tanks are known to exist within AOI 9. Despite this, analyses of soil and groundwater samples have detected petroleum hydrocarbons and solvents, apparently originating from AOI 3, which is located immediately to the southwest of AOI 9, or from former localized waste dumping practices. Two of NASA's RGRP extraction wells were placed in AOI 9 in 1999. The remediation system began operations in September 2001. The oversight agencies for AOI 9 are EPA and the RWQCB.
- AOI 10: the three electrical substations that are not located in any of the other AOIs. Transformer oil containing PCBs was used historically in many of the transformers in the Ames Campus. PCBs were detected above the restricted area clean-up level in one soil sample from the Building N-221C Substation. TEPH was detected above the petroleum hydrocarbon clean-up level in one soil sample from the Building N-227 Unitary Substation. NASA has proposed in-situ bioremediation of fuel-contaminated soils at the Building N-227 Unitary Substation, and excavation of PCB-contaminated soils at the Building N-221C Substation, when the substation is no longer in service. The oversight agency for AOI 10 is DTSC.
- AOI 11: fourteen existing or former underground storage tanks at nine sites not located in other AOIs. All of these tanks have been removed. One (Tank 7) was replaced with a double-wall tank. All of the three former single-wall tanks at the Building N-251 motor pool were replaced with two double-wall tanks. Contamination remains at Tank Sites 7 and U-14. New Tanks 25 and 26 (Motor Pool) are still in use. The remaining tank sites are now clean. The oversight agency for AOI 11 is DTSC.
- AOI 12: the area around Building N-211, the aircraft hangar. Petroleum hydrocarbons are present in a groundwater monitoring well to the east of the hangar either from two former underground storage tanks, or from an

unknown upgradient source. The oversight agencies for AOI 12 are EPA and the RWQCB.

- AOI 13: the wetlands north of and within the North of Bay View area, including the Eastern and Western Diked Marshes, and the Storm Water Retention Pond. This is the same as Navy Site 25. The primary contaminants in these areas are PCBs, DDT, lead and zinc. The Navy has the lead for site investigation and remediation. NASA has also contributed to contamination in AOI 13. The oversight agencies for AOI 13 are EPA and the RWQCB. NASA is also complying with the relevant requirements of USFWS and CDFG.

3. Other Potential Sources of Contamination

This section summarizes known information regarding storage tanks, lead-based paint, asbestos, PCBs, spent abrasive materials, radon, mold, medical/biohazardous waste, and pesticides at Ames Research Center.

a. Storage Tanks

Several hundred underground storage tanks have been present at Ames Research Center, most of which have been removed. The removed tanks are in various stages of the closure and/or remedial investigation process. Many of the aboveground storage tanks, sumps, and oil/water separators were also removed. Tanks that were still needed and in compliance were kept, while others were replaced with double-wall tanks.

b. Lead-Based Paint

Many of the buildings at Ames Research Center have been surveyed for lead-based paint. Because lead-based paint was in common use before 1978, it is assumed that the majority of the buildings at Ames Research Center contain it. Sampling has also found lead contamination in the soils surrounding some of the buildings that had lead-based exterior paint.

c. Asbestos

As with lead-based paint, only a portion of the buildings at Ames Research Center have been tested for asbestos containing materials (ACMs). However, ACM's were in common use into the 1970s, and were found in almost all of the buildings tested. Common ACMs at Ames Research Center include pipe lagging, floor and ceiling tile, sheetrock, waterlines, and gasket material.

d. Polychlorinated Biphenyls

There is a substantial amount of documentation of the presence of Polychlorinated Biphenyls (PCBs) at Ames Research Center, including a basewide inventory conducted by the Navy prior to handover, and quarterly inspections still being carried out by the NASA Environmental Services Office in compliance with 40 CFR 761. Known items containing PCBs include capacitors, regulators, oil fuse cutouts, oil circuit breakers, oil switches, transformers and fluorescent light ballasts. Many of the known pieces of equipment with PCBs have already been removed and disposed of.

NASA is currently preparing an Human Health Risk Assessment for soil contamination from previous agricultural use in the Bay View area. Sampling conducted in 2001 found no PCBs. Low concentrations of metals and pesticides were found, but the levels of contamination were low enough that the risk to human health was below EPA standards for total lifetime exposure.¹⁴ There are two known contamination sites south of the Bay View area at the downgradient end of the off-site Orion Park plume, AOI 5 and AOI 11. NASA is working on the Removal Action Workplans for these two sites.

e. Mold

Different mold varieties can cause a range of illnesses, including infectious diseases, allergies, and dermatitis. Mold has been detected in various buildings

¹⁴ *Surface Soil Investigation Report of Findings/Bay View Redevelopment Area.* August 9, 2001. Prepared by Professional Analysis, Inc. for NASA Ames Research Center, Office of Environmental Services.

within Ames Research Center. NASA has issued guidelines with precautions for entering these buildings.

f. Pesticides

Currently, NASA uses the herbicides Round-up, Rodeo, Direx 4L, Surflan, and Turflon, and the pesticides Gas cartridges, Maxforce gran, Tempo dust, Avert, Terro ant bait, Dagnet, and BP 100.¹⁵ A number of other pesticides were used at Moffett Field in the past, and there is a potential for residual levels of chemicals in soil. In particular, the pesticide dieldren has been found in surface soil samples in the Bay View area in concentrations above residential risk-based screening levels.

g. Other Potential Sources

Some medical or biohazardous waste has been and is generated within Ames Research Center. At present, very small quantities of medical and biohazardous wastes are generated in three locations at the Center as a result of research activities and the operation of the Center's Health Unit. There are a few locations where uncontrolled blasting could have occurred at Ames Research Center, such as the wind tunnels. Testing has not found any radon levels above the EPA's action levels.¹⁶

E. Adjacent Off-Site Contamination

During the investigation and monitoring activities for NASA AOIs 4 and 11, low levels of TCE were discovered in the groundwater in Orion Park. In order to locate the source of TCE, NASA conducted several investigations. A review

¹⁵ *Draft Environmental Resources Document for the National Aeronautics and Space Administration Ames Research Center*. March 2000. pp. 202-03.

¹⁶ *Environmental Baseline Survey*, Harding Lawson Associates. October 18, 2000. pp.17- 23.

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of well data and subsurface geology indicates that the TCE is coming from the off-site housing area, and then flowing beneath the western portion of the Ames Campus. The US Navy is planning to continue with the investigation of Orion Park in order to determine the source of the TCE. NASA is also planning further investigation of the area to better define subsurface conditions with the goal of implementing some control measures to prevent further migration of the TCE onto the Ames Campus and to prevent its migration beneath Bay View. Potential hazardous materials contamination may also exist in the nearby Mountain View industrial area, where some hazardous materials users operate.